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Technical Education

Ever since the war the development of technical education has been under discussion. But except for an abortive proposal by the Labour Government there has been no overall plan. The lack of a plan has not of course entirely prevented development. The capacity of the universities for example has been very largely expanded. By comparison with 1938/39 there has been an increase in the number of university students of science and technology of 124 per cent and they now represent 34½ per cent of university student populations as against 26 per cent before the war. The probability is that in its plans for the next quinquennium the University Grants Committee will provide for a further expansion and—it is to be hoped—for an expansion of technological courses relative to science courses. What has been lacking since the war has been sufficient encouragement to technical colleges to expand their facilities. Now under the plan outlined in a White Paper issued last week the immediate objectives for England and Wales are to increase by 50 per cent the output of students from advanced courses at technical colleges and to double the number of youngsters released by their employers for part time courses during the day. Similar provisions apply to Scotland. For the necessary new buildings and their equipment about £95 million will be made available for expenditure over a 5-year period. Scientific education is also to be improved in all types of secondary school. Unfortunately, owing to printing troubles and our consequent inability to set more than a very few columns of new matter each week, space is not available adequately to discuss the White Paper. It is, however, worth while remarking, with approval, upon the proposal to give "sandwich" courses particular attention; to note that, we think for the first time, the term technician is used in a Government educational document to denote someone with qualifications less advanced than those of a technologist; and to show interest in the suggestion that many more girls than heretofore might be attracted to scientific and technological careers. Certainly there are proposals in the White Paper with which complete agreement must be withheld. But wholehearted approval of the general intentions of the government can certainly be expressed. If this country is to hold its own technologically in the future, plans are long overdue for the expansion of educational facilities.

Restrictive Trade Practices Bill

As we go to press, the Restrictive Trade Practices Bill is being debated in the House of Commons. At the beginning of the week, the Federation of British Industries, the National Union of Manufacturers, and the Association of British Chambers of Commerce jointly issued a statement commenting on various clauses of the Bill. This statement says that the object and procedure specified by the Bill sound reasonable, for the three organisations "have never believed that restrictive practices are either always in the public interest or always to its detriment." But, the statement continues, the Bill provides that the judicial tribunal must presume the agreement to be against the public interest unless it passes certain limited tests. The burden of showing justification for an agreement is placed on the parties to it, which, the statement asserts, might be reasonable if they were able to produce all relevant arguments to support their case. The three associations contend, however, that the Bill severely limits the grounds for justification, and pays far too little regard to the interest of the industry concerned, which is itself an important part of the national interest. Another criticism expressed in the statement is that the Bill defines "in far too imprecise terms" the classes of agreements to be examined by the tribunal and registered. Much more definition is required, it is urged, if the register is not to be clogged with paper describing agreements that no stretch of the imagination could call restrictive.

Atomic Energy and Propulsion

The prospects of applying atomic energy to propulsion, with particular reference to railways, were discussed by Sir John Cockcroft, director of the Atomic Energy Research Establishment, Harwell, when he gave the Sir Seymour Biscoe Tritton lecture to the Institution of Locomotive Engineers in London on February 29th. Sir John said that the application of atomic energy to ship propulsion had been shown to be technically feasible by the successful operation of the U.S. submarine "Nautilus", but the costs were much higher than those of conventional methods of propulsion. Sir John referred to information given in the U.S. Congressional Record (May 1955) about the economics of the Nautilus-type power unit applied to a commercial ship developing 18,000s.h.p.: compared with conventional propulsion methods the fuel costs were increased fourfold and the capital costs tenfold. However there was considerable scope for cost reduction and a recent report of the U.S. joint congressional committee had estimated that a nuclear propulsion unit for a large tanker could be built for about half the cost of the Nautilus unit. The development of other kinds of reactors offered even further scope for improvement. In aircraft propulsion by atomic energy, the main technical problem was to build a reactor generating heat at a high enough temperature, 700 to 800 deg. Cent. for a gas turbine propulsion unit. Assuming that it was practicable to extract 100 MW of heat from a cylindrical reactor core of 2ft. diameter and that a 4ft. thick shield was tolerable, it would weigh fifty tons. The McKinney report of the U.S. joint congressional committee indicated that nuclear energy was unlikely to have any major impact on civil aviation for the next 15 or 20 years. Economic considerations would be a determining factor in locomotive propulsion by atomic energy. Sir John quoted an American paper which showed that a present day reactor providing heat for a 3000 h.p. gas-turbine-electric locomotive would give overall costs about 2½ times those of diesel traction. Having "transferred the problem of the atomic locomotive to the next generation" Sir John went on to discuss how the advent of atomic energy might affect rail transport through the medium of railway electrification. There was a prospect of saving 7,000,000 tons of coal annually by conversion to electric and diesel traction. If uranium prices and atomic power station costs followed predicted trends, electricity costs should continue to fall relatively to oil costs and electric traction was likely to become increasingly attractive to British Railways.

North of Scotland Hydro-Electric Board

The annual report of the North of Scotland Hydro-Electric Board was published last week. For the first time there was a loss on the years' accounts, totalling £782,154 the years' revenue being £8,855,104. A combination of unfavourable circumstances is blamed, namely a year of exceptionally light rainfall, continuing inflation and increased interest charges. Because of the drought, more coal had to be burned at the Board's steam stations and some electricity was imported from the South of Scotland. The Board sold 1245 million units during 1955, of which about 91% was to consumers in the North of Scotland area. However, the potential output of hydro-electric schemes (based on average rainfall) was increased to 1469 million units per annum. Hydro-electric generating sets totalling 127MW were brought into operation at Clachan (Shira scheme) Torr Achilty (Conon Valley) Errochty (Tummel Garry) Quoich (Garry) Finlarig (Lawers) and Mullardoch tunnel (Affric). Hydro-Electric capacity thus reached 559MW at the end of the year (including 85MW in the pre-war Grampian scheme). Figures for installed capacity and average annual output were respectively 311MW & 952 million kWh for schemes under construction, and 418MW and 1281 million kWh for schemes in course of promotion and survey. A point of special interest in the new developements is the attention being given to pumped storage schemes for peak load generation, because of the proposed establishment of base load nuclear power station's in the Board's area. Promising pumped storage sites are being investigated at Cruachan (Loch Awe) Burn of Mar (Balmaha) and Loch Sloy.

Engineering Wages

Negotiations on wages between the Engineering and Allied Employers National Federation and the Confederation of Shipbuilding and Engineering Unions were resumed on Wednesday, February 28th. After the meeting it was announced that the unions had accepted an offer by the employers of increases of 12s. 6d. a week for skilled men, 11s. for semi-skilled, and 9s. 6d. for unskilled men employed in the engineering industry. These increases dated from last Monday, March 5th. They represent a rise of approximately 8 per cent on the old rates. When the claim was first discussed at the end of December, the union representatives pressed for an increase of 15 per cent, and on February 17th. they rejected an offer, approximating to about 7 per cent, which the employers then made. The settlement brings the weekly minimum basic wage of a skilled man to £8. 8s. 4d. As we go to press, negotiations are proceeding between the unions and the Shipbuilding Employers' Federation on a similar claim for shipbuilding workers.

LITERATURE

Mechanism. By JOSEPH STILES BEGGS. London: McGraw-Hill Publishing Company, Ltd., 95, Farringdon Street, E.C.4. Price 49s.

IN the glossary, the author explains that "mechanism," as used in this book, includes all kinds of links, such as gears and cams, not just kinematic links. In the text, however, he has attached a more generous meaning to his title and the result is a volume of great value and lasting interest for the mechanical engineer. Certainly this is an engineer's book; the introductory chapter establishes that as it sets out that the design of the mechanism must be dependent on the design of its members and that both are dominated by the needs of the operator. An excellent exposition of some of the more basic requirements of machines follows, ending on a familiar theme: "Many successful designers justify the spending of considerable time maintaining such mechanisms (domestic devices, motor-cycles, automobiles) because they learn both the good and the bad features of designs from the way they stand up on the job." For the student, this introduction alone would commend the text, but this emphasis on the ultimate need for a practical product is sustained throughout. The author, generally, seeks to teach by example, and the examples range over an extremely wide field, from electrical relays to optical prisms.

A chapter on position, velocity and acceleration is largely theoretical, demonstrating both graphical and analytical approaches to plane and space mechanisms. Gears, toothed and friction, of circular and other profiles are studied and particular attention is paid to the power losses in planetary trains. Assuming that a calculating machine will be available, the author does not hesitate to discuss the design of gear trains, and reproduces Lancaster's charts. Generation is the only method of tooth forming discussed, and its application to couplings is also shown. The problems of cams lie less with the design than the manufacture, and hard experience is mirrored in the pages; the author clearly favours polydyne profiles, and also is interested in devices providing positive control in both directions. The problems besetting push-rod overhead valve gear are studied by use of the Laplace transform.

The chapter on rotary drives discusses mechanical, magnetic, eddy-current and hydraulic couplings before proceeding by a symmetrical self-wrapping brake to variable speed devices, almost the simplest of which is an all-helical transmission; this chapter, however, would be the place for one of the very few important mechanisms that are not mentioned, the limited slip differential. As the reader will have come to expect, linkages are covered comprehensively for motions both plane and spatial: examples range from Stephenson valve gear to Lincoln ball-joint wishbone suspension. Tension and flexural links mentioned run from rope blocks and tackle reeved to prevent tipping to elastic locking and fastening devices; compression links, principally hydraulic, are described in action in various processes.

Ingenious calculators and elegant planimeters preface the treatment of computing mechanisms, which also includes several of the elements of analogue computers. The subject of the control of mechanisms allows the author to study electric, hydraulic and pneumatic devices of varying complexity. Under the heading "Special Topics," the need for, and the impossibility of, kinematic design is introduced, together with the storage of information. A remarkable collection of designs and devices appears in the repertory of mechanism that forms the last chapter. The appendix on United States patent law is plainly worded and illuminating; in the extensive classified bibliography, United States sources outnumber European references. Study of the index confirms that labour has been lavished to make this a work worthy of its fascinating subject.

Mine Rescue Work. By R. MCADAM and D. DAVIDSON. Edinburgh: Oliver and Boyd, Ltd., Tweedle Court, 1. Price 21s.

As the title of this book implies, it is concerned with the work of rescuing men injured or endangered by accidents in mines. Explosions of firedamp or of coal-dust are chief among these, and fires thus initiated or arising from devious other sources, and flooding, may also call for rescue work. The authors state that their aim is to write a modern textbook for mining students and a reference book for members of rescue brigades and for all concerned with their efficiency. They have fully achieved their object.

In a brief historic review of the subject we are reminded that it was so recently as 1906 that 1100 lives were lost in the Courrières disaster, and in 1907 the Royal Commission on Mines advised the further development of rescue apparatus in this country and the establishment of central rescue stations to provide training in its use. The Coal Mines Act, 1911, provided for the formation of rescue brigades and for the supply and maintenance of rescue apparatus; the original Regulations became effective in 1913. Because some of the early kinds of breathing apparatus had serious defects, research on the subject was begun in 1917 at Heriot-Watt College Mine Rescue Station, and as a result further Regulations were made in 1920; they were revised in the 1928 Regulations which have now been in force for over twenty-five years.

The principles, construction and mode of operation of the many kinds of breathing apparatus used in mine rescue work are described in detail with the aid of excellent line diagrams and photographs. The second half of the book deals with resuscitation and transport of casualties, with fighting and suppressing mine fires, with the various gases and atmospheric conditions to be coped with during rescue work; it also deals with breathing apparatus for use under water. In the last two chapters the planning and organisation of rescue work are treated separately. Extracts from the 1928 Regulations are given, together with a useful series of comments on their application, and the normal procedure as now established by experience of them. In 1951 the Rescue Advisory Committee of the N.C.B. prepared a guide to necessary preparations of this kind, and all colliery units in Great Britain now have detailed plans of action ready to cope with a major accident such as a large explosion or fire.

The construction and operation of four types of self-contained breathing apparatus using compressed oxygen are described, namely, the Proto Mark IV two-hour apparatus, which is the most popular of those used in this country and is also in common use in Africa, Australia, Canada and India; the Lungovox apparatus, which is made by the same company, Siebe, Gorman and Co. Ltd.; the McCaa apparatus, which is standard for mine rescue work in the U.S.A. and is made by the Mine Safety Appliances Company of Pittsburgh, and the Draeger Model "BG400," recently produced by Messrs. Draeger of Lübeck, Germany. In the last three the amount of oxygen supplied to the wearer is automatically related to his needs as indicated by the frequency and depth of his breathing.

Liquid air breathing apparatus is used only at four rescue stations under the N.C.B., and after describing the two types in use a comparison is made with those using oxygen showing the disadvantages of this system.

Escape and self-rescue apparatus serve to protect men against noxious gases and smoke caused by a fire or explosion, or from other sources. They fall into two main classes; one is self-contained and one gives protection against carbon-monoxide poisoning, but does not supply oxygen. Three examples of the first class and six of the second class are described. They are all essentially simpler, lighter and of lesser endurance than the apparatus used by rescue teams.

Railway Commercial Practice: Supplement to Volumes I and II. By H. F. SANDERSON. London: Chapman and Hall, Ltd., 37, Essex Street, W.C.2. Price 3s. 6d.

THIS supplement to Mr. Sanderson's volumes published in 1952 is designed to bring the previous information up to date, and includes the main features of the 1953 Transport Act and the new organisation of the British Transport Commission and British Railways, introduced largely as a result of the Act. It also covers the maximum charges scheme for merchandise submitted to the Transport Tribunal in March, 1955, and an outline of the plan for the modernisation of British Railways. It is pointed out that the references to the Railway Executive and other executives in the 1952 volumes should now be amended in accordance with the title of the management by which they have been replaced.

Strength of Materials. By B. B. LOW. London: Longmans, Green and Co., Ltd., 6 and 7, Clifford Street, W.1. Price 18s. 6d.

THE second edition of this textbook contains additional chapters on the testing of materials and the mechanical properties of materials. The latter chapter contains notes on such relatively new materials as Nimonic alloys and titanium alloys. Generally, the standard of tuition aimed at in the book is that required by the leading engineering institutions.

Books Received

Fluid Mechanics. Third edition. By R. C. Binder. Constable and Co., Ltd., 10, Orange Street, London, W.C.2. Price 45s.

Boiler Plant Technology. Third edition. By R. L. Batley and E. Gordon Barber. Sir Isaac Pitman and Sons, Ltd., 39, Parker Street, London, W.C.2. Price 25s.

Basic Mathematics for Science and Engineering. By P. J. Andres, H. J. Miser and H. Reingold. Chapman and Hall, Ltd., 37, Essex Street, London, W.C.2. Price 54s.

Radio and Electronic Components. First edition. Volume I. *Fixed Resistors.* By G. W. A. Dummer. Sir Isaac Pitman and Sons, Ltd., 39, Parker Street, London, W.C.2. Price 28s.

The History of the Tropenas Process

By ERIC N. SIMONS

THE Tropenas process in use to-day in many steel foundries is an improvement upon the Bessemer process of steel manufacture. One of the drawbacks of the Bessemer process was the heavy air pressure required to force the blast right through the body of the bath from bottom to surface and the difficulty of keeping the metal hot enough during the process of casting. An alternative steel foundry process that was first designed to overcome these difficulties was invented by a Monsieur Robert, of France, towards the end of 1886.

Alexandre Tropenas was the general manager of the Société Industrielle de Fonderie de Bronze, and in this capacity became interested in the Robert converter. In this the tuyères or pipes for the introduction of the air blast were set at a tangent to the surface of the metal in the converter, and as the air entered below the surface of the metal, it imparted a rotary motion to the bath and so, Robert claimed, brought about a more rapid and complete purification and conversion of the iron into steel.

Tropenas persuaded his employers to make steel castings by the Robert process, and a converter was installed, but the results were unsatisfactory. Several good hot blows would be followed by several others that were cold. The steel also rose in the moulds owing to excessive oxygen, overflowed, and produced spongy castings.

After failing to obtain help from Robert, Tropenas decided that the theory of tangential tuyères with the bath inclined to produce a gyratory motion was unnecessary, and began experiments on his own account. After approximately a year's research, he became convinced that success with the small converter for making steel castings could be achieved only by blowing across the surface of the metal.

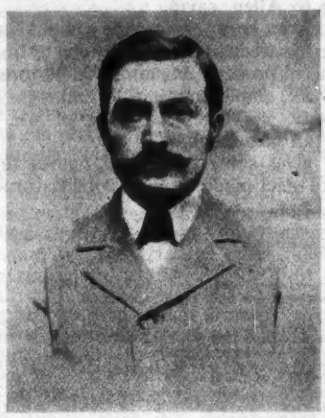
In 1887, Robert Woodward, a partner in the firm of Samuel Osborn and Co., Sheffield, had met Tropenas in Paris. In 1890, Woodward, with his friend from the same firm, Alfred E. Wells, became Directors of the newly-established Edgar Allen and Co., Ltd., a private company formed by William Edgar Allen, then a steel manufacturer and merchant in Sheffield. Allen was contemplating marriage and was anxious to rid himself of some of the responsibilities of managing his own firm, Edgar Allen and Co., which he had founded in 1868. Woodward and Wells persuaded Allen to establish a foundry for the manufacture of steel castings.

Castings were first produced by the Siemens open-hearth process, but later it was decided to install a Robert converter; it was not, however, until August, 1890, that satisfactory terms for the granting of a licence to operate this converter could be agreed upon. Robert had stressed the need of a skilled operator from Paris to supervise the erection and operation of the plant, but meantime Woodward, recalling his meeting with Tropenas some years earlier, was already in communication with him and stated clearly in a letter to the Robert Steel and Iron Company, Ltd., 28, Victoria Street, London, that "we intend availing ourselves of his services for several months in connection with this department of our business."

At Woodward's instigation, Edgar Allen, chairman of the new company, had met Tropenas at the great Paris Exhibition and had also visited his works, in 1889. In 1890, Wells also went to France and with Tropenas visited a number of works in which Robert converters were installed. On August 27, 1890, Edgar Allen wrote to Tropenas in French to the following effect:

"We have pleasure in accepting the conditions proposed by you for your personal attention and supervision of the work of installing the Robert-Bessemer process in our Sheffield works."

Installation of the equipment was, however, held up because Robert would not or could not supply detailed drawings and working specifications of the fixed converter and its attachments. On October 2, 1890, Woodward wrote to the Robert Steel and Iron Company, Ltd.: "We have taken up this process and regard it as experimental to a very large extent, and we certainly do feel that you are not giving us the information you ought to be in a position to give to anyone starting a Robert installation."



M. Tropenas

Meantime, the firm had bought a second-hand converter from the Blaenavon Company, and also a blowing engine, and on November 5th, Edgar Allen wrote to Tropenas:

"We credit you with fr. 624·50 on the 31st Oct. as balance" (of 1000 frs. earlier agreed upon as his fee). "We shall pay the cost of your journey between Sheffield and Paris, and we shall allow you £1 a day on which you are working on our behalf, including Sundays and holidays, to be paid monthly. We shall pay all your expenses of a personal character, including lodging, food, &c."

Meantime, Tropenas, with further experience at Sheffield of the drawbacks of the Robert converter, began to propound his own ideas, and on February 4, 1891, Woodward wrote to Allen:

"Mr. Tropenas thinks he has information which would be useful to us and which he is ready to give to us, provided that if we take out a patent for any of them he be allowed to use the information abroad without paying royalty:

"1st. Quick annealing.

"2nd. Better skin to Castings than we now get.

"3rd. To make Tram Wheels, e.g. with hard rims and soft arms and bosses or any Castings partly hard and partly soft.

"4th. To make our name on Castings much clearer than now.

"5th. The substitution of Sand for Dry Sand Castings instead of using composition which is much more expensive than sand.

"Both Wells and I are quite willing to receive his information on his terms on these points, and no doubt you will acquiesce.

"He (Tropenas) has propounded to us a method by which Carbon can be taken by a kind of colour test during the operation of blowing. Wells and he have elaborated it, and it is proposed to protect it by Patent. . . . The Patent to be taken out . . . as a communication from Tropenas of Paris. Then an agreet. to be made between Tropenas and ourselves by which we become joint owners with him ($\frac{1}{2}$ and $\frac{1}{2}$), he and we sharing the expenses equally. This to apply to Patents taken in all countries if taken. We bear the expense of the trial at our works and if a success it will be a very useful process.

"Tropenas Process: Call it No. 2 Process.—This is on the lines he indicated to us last year. Wells and I have agreed to allow him to put down a small Converter at Tinsley at his own cost, we supplying him with the blast and materials to be blasted (!!). If the process be a success, (and he doesn't appear to entertain a single doubt about it) we to have the liberty of taking over the apparatus at cost price and take a licence from him at not more Roy. per ton than we pay for B. Dept. I forget as I write . . . whether we are to be joint owners of the English Patent for this No. 2 Process.

"He is confident of making excellent Tool Steel by this No. 2 process, and he wants a higher Royalty for such Steel if we make it—perhaps 10/- to 20/- a ton—he hasn't named any figure. He wishes also to have the liberty of bringing anyone to our Works to see this process in operation.

"He seems very confident that the No. 2 process will supersede the B. Dept." (Robert) "process; but if so, the B. Converter can be altered and we should abandon the B. Licence.

"He is, I think, most fair in his proposals, and as the time is fast approaching when we shall get to work in B. Dept. (say middle of March) the arrangement with him should be reduced to writing as soon as possible."

The time was fast approaching when the firm's 800 lb capacity Robert converter would be operated, and Robert wished to send one of his own engineers from Paris to supervise production. By now the firm were exasperated with his methods and against this, in which Tropenas concurred. Woodward wrote to Allen on February 28, 1891:

"We propose to start the apparatus under Tropenas's care, and if he should fail to produce the desired results, then we can have a man from Paris. But Wells and I are quite content to run the risk of failure. We do not think there is any risk. . . . Both Wells and I are in great hopes that the No. 2 process will enable us to chuck the other overboard.

"Do you think that if the No. 2 process turns out a great success, it would be well for us to secure it for ourselves only in Sheffield and say 12 miles round (radius of 12 miles)?"

On January 7, 1892, it was felt that the time had come to put on a proper legal footing the arrangement with Tropenas, and the following were the main headings put forward:—"Edgar Allen & Co. Ltd. to purchase the patent rights for Great Britain, Ireland and the Channel Islands. After the Process (with the large Converter now being erected) has been working successfully to the satisfaction of the Directors for a period of 3 months, the Coy. to pay M.

Tropenas 10,000 francs in cash. The Coy. to pay M. Tropenas the following Royalties :

" 1/– p. ton on all sound and merchantable ingots topped or not topped.

" 4/– p. ton on all Castings sold which have been made by this process.

" If the Coy. grant licences for this Process, one half the Royalties received by the Coy. under such Licences are to be paid to M. Tropenas.

" M. Tropenas pays the cost of taking out the Complete Specification for Gt. Britain, and the Coy. to pay all renewal fees thereafter.

" M. Tropenas to communicate to the Coy. any and all improvements he may discover in connexion with this process whether the sd. improvements be patented or not and the Coy. are to have the free use of all such improvements. The Coy. to communicate in like manner to M. Tropenas any improvements they or their Servants may discover in connexion with this Process, and M. Tropenas to have the free use thereof out of the U.K.

" M. Tropenas to be allowed to show the Process in operation at the Coy's works to people who may think of adopting it abroad.

" M. Tropenas to supply working drawings for Plant to be erected for the production of Steel by this process and (if necessary) to superintend its erection and carry it into operation. Licencees to pay cost of such drawings and personal services to be agreed upon between him and the Coy. and are to be set forth in this Agreet."

Up to the end of November, 1891, the Company had sold only about 120 tons of castings, the steel for which had been melted in the Robert converter, and as a 2-ton cupola and Tropenas converter were, in January, 1892, only six weeks from completion and operation, it became doubtful whether it would be wise for the firm to apply for an official licence from the Robert firm. Up to that date the firm had been " working on sufferance, not under licence " from them. They had twelve months previously pressed Robert's London house to complete the licence, but at their (Robert's) request, the matter was postponed.

On March 3, 1892, Woodward wrote :

" . . . after giving the subject the fullest consideration, the Directors have arrived at the decision to abandon the idea of taking a Licence for the ' Robert Process,' and they have given instructions for the Converter to be disused and dismantled forthwith. . . . You were unable to give us working drawings of any part of the Plant or any information whatever as to the Machinery and Appliances necessary thereto. This we have had to obtain at great cost to ourselves. . . ."

After some acrimonious correspondence the firm stated that during the period in which they had had the Robert process on trial they had made and sold up to December 31, 1891, 150 tons of steel castings, and from January 1 to March 18, 1892, a further 92 tons. They had in stock 8 tons 13 cwt. In the same period they had made 2 tons 17½ cwt of ingots. A cheque for the total amount of royalty due was sent, and this closed the chapter of the manufacture of steel and castings by the rival process. The field was now Tropenas's own for him to exploit.

That the Tropenas process was justifying the inventor's view of it seems obvious from a letter of April 29, 1892, written by Woodward to Edgar Allen, in which he states that " it is working satisfactorily (in the large Converter, about 30 to 33 cwt. charges)." Tests were made by Thomas Nash, of Sheffield, on a number of test pieces, 2in long between gauge points, and with carbon contents ranging from 0·290 to 0·420 per cent. These gave for 0·290 carbon a tensile of 27·36 tons per square inch, and for the 0·420 carbon 33·76 tons, with elongations of 36 per cent and 30·5 per cent respectively, reduction of area percentage being 56·8 and 42·7 per cent.

In a search for a suitable hematite pig iron to use in the process the firm came upon the brand " Barrow," the composition of which was said to be : graphitic carbon, 3·385 per cent ; combined carbon, 0·350 per cent ; silicon, 2·581 per cent ; sulphur, 0·017 per cent ; phosphorus, 0·047 per cent ; and manganese, 0·504 per cent. The " yellow " sand used for making the castings had a composition of silica, 89·90 per cent ; peroxide of iron, 1·82 per cent ; alumina, 6·68 per cent ; lime, 0·25 per cent ; magnesia, 0·18 per cent.

Meantime, a sealed Patent No. 7625, dated May 2, 1891, was received for the Tropenas process. On July 1, 1892, Alfred E. Wells, who was in charge of the firm's steel foundry, wrote to Tropenas :

" We have now had 203 operations from No. 2 " (the Tropenas converter) " and all have been good, and the carbons are as a rule very regular. We have very few scraps to dispose of now, because we put nearly all small and medium-sized ones in cupola—we only sell the large runners."

On the 18th of the same month Wells wrote to Allen, saying :

". . . we kept the crucible gas-pot furnace going for weeks (whilst we were testing the ' Robert ' process), burning abt. 40 tons coal per week, employing man to make gas night and day, making pots, none of wh. have been put into stock."

He gives some interesting figures for the cost of steel made by the Tropenas process :

	£	s.	d.
Hematite iron, 204 tons 5 cwt	613	2	10
Less one-sixth for waste, 34 1 0			
170 4 0			
Ferro-manganese, 2 tons 17 cwt. 3 qr 20 lb at 120s....	17	11	2
Ferro-silicon, 2 tons 1 cwt 1 qr 1 lb at 80s. 6d.... ...	8	6	0
	639	0	0
Coke for cupola, 31 tons 3 cwt at 20s.	31	3	0
Limestone, 8 tons 6 cwt 3 qr at 6s.	2	9	8
Ganister, 10 tons 9 cwt 0 qr at 12s. 6d.	6	10	8
Sand, 2 tons 4 cwt 2 qr at 4s. 8d....	10		4
Coke for converter, 32 tons 18 cwt 0 qr at 13s. 6d....	22	4	2
Melters' wages	91	5	3
Repairs and maintenance	15	1	0
Repairs and maintenance : materials	22	18	10
	£831	2	11

To this had to be added £63 for salaries, &c., making a total cost of £894 2s. 11d., or £5 5s. per ton, with a selling price of £6 per ton.

The gas plant referred to had been put down because Woodward and Wells thought at the time the Robert converter was installed that it " would not do to trust ourselves to the Robert Process, and that consequently, it would be best to adopt a system of melting we did understand. Events have shown that it would have been better if we had trusted to Tropenas's opinion rather than to our own opinions . . . . " " spending money on the Robert process and working with it . . at the time was thought to be the right thing to do : but experience has taught us that it wd. have been best to have adopted the Tropenas process from the beginning."

In October, 1892, Woodward wrote to Tropenas, who was now back in Paris : " Would you recommend us to put up the hot-air pipes when we have opportunity ? Do you think the use of hot air in the Converter would have the effect of making the Steel not only hotter but even more ductile than it is now when cold ? "

It should be noted that when in England Tropenas lived in Rotherham, where several of his children were born. In the early months he was handicapped to some extent by an imperfect knowledge of the English language and methods, weights and measures, &c. Wells, however, acted as his mentor, and the entire resources of the firm were placed at his disposal. By 1893 the Robert Company in London was in liquidation and the French Government had refused to allow steel castings made by the Robert process to be used in any of their government factories because of their unreliability.

By means of the new process it became possible for the first time to manufacture high permeability steel castings for the electrical industry in place of wrought iron forgings, and the development of this branch of the steel foundry industry was of the greatest advantage to the firm in its struggle to win a footing in a highly competitive world.

Tropenas had been instrumental in obtaining a Continental source of supply for moulding sand, for which, in July, 1893, the firm was paying 10 francs per 1000 kg. It was stated to be excellent in quality. By the end of June, 1893, the steel foundry was producing 178 tons a quarter of steel castings and 7½ tons of steel ingots, by the Tropenas process, and cheques for royalties due were regularly sent each quarter to the inventor in Paris.

In August of the same year Tropenas secured a patent for his process in the United States. He had spent in all nearly twelve months at the Edgar Allen works, and early in 1894 was actively superintending the putting down of his process and making steel thereby at a works in Boulogne owned by Monsieur Plichon. By April of 1894 the quarterly Edgar Allen production of steel castings by the Tropenas process had risen from 178 tons a quarter to 280 tons, and ingots from 7½ tons to 16½ tons. On May 10th of that year Woodward was able to declare to Allen :

" The growth of our Foundry Trade shows that we are now firmly established as Steel Founders. It remains to increase the output, to decrease (if possible) the costs of production, and to provide further facilities for dealing with the increased production."

There was some talk of putting down a 4-ton converter, but finally it was decided to alter the old converter, which work was still in progress early in 1895. Meantime, castings for the British Admiralty were giving 25 per cent elongation in 2in, and 28 tons tensile, which tests the firm guaranteed. Wells wrote on December 18, 1894 :

" We can shank at least 30 cwts at a time of very mild steel, such as would give the foregoing (named) tests, with 1½ cwt. shanks, and make pieces only a few ozs. each. We shall not grant a licence to outside competing firms, but would do so to the Govt. on terms to be arranged. . . . We are, from what I can hear, the only Steel Founders that are busy, and the bulk of our work is subject to severe tests. We have never had a single casting rejected on a/c of test, but on the average give 50 per cent more elongation than specified." (He quotes figures showing a range from 26·88 tons tensile to 38·52, and 24·0 per cent elongation to 35·5 per cent.) " The above were taken from Castings made by our own Patent process, were tested in their cast conditions in presence of the respective Inspectors, and only represent what we get from our Engineers' quality castings."

By September 30, 1895, the castings made by the Tropenas process had mounted to 466½ tons per quarter, and ingots had shrunk to 6 tons, largely because, as was stated in correspondence, the orders for steel castings were absorbing all the steel that the converters could produce. The firm was obtaining moulding sand from Fontenay-aux-Roses, near Paris, but they did not like to be dependent on a foreign country for their

supplies and tried to find an English source, but were not too successful.

Tropenas, in early 1896, was in Russia negotiating for the installation of his process in that country, but he returned in the July, at about which time it became clear that the British War Office were contemplating the installation of a Tropenas plant at the Royal Arsenal, Woolwich. Negotiations proceeded and on October 14, 1896, Woodward summed up the advantages of the process in the following words, addressed to the Director of Army Contracts :—

"(*a*) When the converters are temporarily out of use, or not worked at night, it is not necessary to burn fuel to keep them hot as in the case of Open Hearth Furnaces.

"(*b*) The heat obtained in this Process being greater than that of any other Pneumatic Process, or in an Open Hearth, the Steel retains its fluidity for a much longer time after it is run from the Converter.

"(*c*) This extreme fluidity enables you to carry the Steel long distances in small ladles, and to make the most intricate Castings, and the smallest Castings, without undue waste. It also enables you to make large Castings by keeping successive Casts in a ladle or ladles without fear of making waste in 'skulls.' We have frequently accumulated 6, 7 and 8 tons of Molten Steel and then poured it into moulds without any 'skull' whatever. The time occupied in such operations varies up to about an hour and three-quarters.

"(*d*) With this process, the Moulding Boxes may be liberated very rapidly and the output of the Foundry is not only thereby increased, but the operations may be carried on with a smaller Stock of Boxes than with the Open Hearth.

"(*e*) Repairs to Converters. These can be done with much less loss of time than in the case of an Open Hearth. For example, if a Tropenas Converter is stopped at 6 p.m. it can be re-lined and ready for use at 6 p.m. the following day.

"(*f*) The Tropenas Steel possesses a Ductility at High Tensiles which is not found, so far as we know, in Steel made by any other Process from Ordinary Hematite Pig Irons.

"(*g*) The Tropenas Process combines the rapidity of the Bessemer Process with more than the quality obtained from the Open Hearth, and has the distributing facility (for small pieces) of the Crucible."

In 1897, C. K. Everitt, later to become Chairman of Edgar Allen and Co., Ltd., was sent to supervise the installation by the firm of a Tropenas plant at the Arsenal, and on September 15, 1897, an agreement for this installation was signed, payment being made on a royalty basis. Everitt also superintended the installation of Tropenas converters at the works of the Lancashire and Yorkshire Railway Company, Horwich, in 1898, and in 1899 at Vickers, Son and Maxim, Ltd., Barrow-in-Furness. The Tropenas process had arrived.

Torque Converters

A RANGE of three-stage hydrodynamic torque converters licensed by the Twin Disc Clutch Company, U.S.A., will shortly be in production at Rolls-Royce, Ltd., for use with its diesel engines. The converters are available in three sizes and three forms : the forms are a plain converter mounted either on the engine or a separate housing, a converter with a disconnecting clutch between it and the engine, and a converter incorporating a direct-drive clutch to lock the output shaft to the input, the impeller being then declutched and the turbine, which drives through a freewheel, coming to rest. Both the latter forms include freewheels between input and output to allow the engine to be started by torque applied through the converter. The three sizes cover powers between 600 h.p. at 1800 r.p.m. and 60 h.p. at lower speeds. Fig. 1 shows the general arrangement of a converter : the impeller blades are marked *A*, the three rings of turbine blades *B*1, *B*2, and *B*3, and the stator blades *C*1 and *C*2. The converter illustrated incorporates concentric hydraulically actuated multiplate clutches : for operation as a converter the outer clutch alone is engaged and drives the impeller. At a sufficiently high output speed the outer clutch is freed and the inner clutch *E* closed. However, by engaging the outer clutch again a considerable amount of hydraulic braking is available, since, as can be seen from Fig. 2, the input torque falls off very little when the turbine is unloaded. In a typical application the hydraulic power dissipation, being dependent on the cube of the speed, rises from being slightly greater than the engine braking at 1200 r.p.m. to more than 2·5 times as large at 2100 r.p.m. when it is approaching the engine power output. This characteristic allows a valuable increase in power output in cases where a critical engine speed dictates the governor setting.

The working medium of the converter can be either special fluid or diesel oil, the latter being attractive on remote sites.

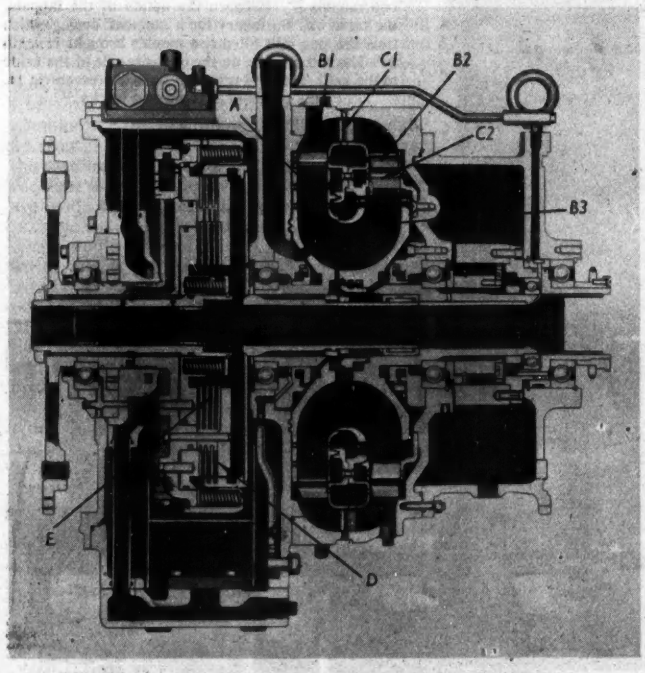


Fig. 1—Torque converter providing direct drive.

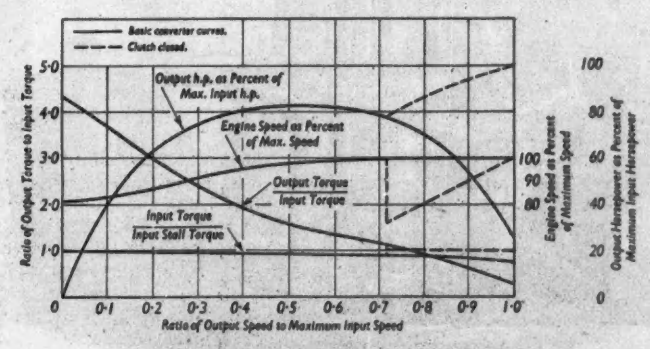

Basic converter curves.
Clutch closed.
Output h.p. as Percent of Max. Input h.p.
Engine Speed as Percent of Max. Speed
Output Torque
Input Torque
Input Torque
Input Stall Torque
Ratio of Output Torque to Input Torque
Engine Speed as Percent of Maximum Speed
Output Horsepower as Percent of Maximum Input Horsepower
Ratio of Output Speed to Maximum Input Speed

Fig. 2—Performance of engine and converter unit

Association of Consulting Engineers

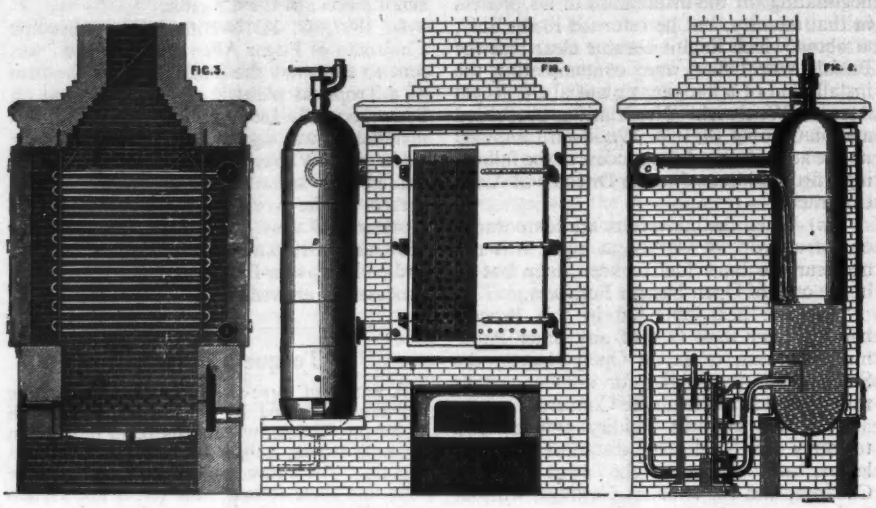
The annual dinner of the Association of Consulting Engineers was held at the Dorchester hotel on February 20th. In the speeches, a principal theme, which has been stressed by Government speakers more or less annually at this function for some years, was the importance of obtaining consulting work overseas. The toast of "the Association" was proposed by the Earl of Home, Secretary of State for Commonwealth Relations, and the Chairman of the Association, Mr. Julian S. Tritton, responded. Mr. Tritton referred to recent changes of the Association's rules to meet overseas conditions where the so-called "turnkey" bid was popular. He also noted that international conditions of contract were being drawn up, the bodies interested in this development being the Export Group for the Constructional Industries, and the Federation Internationale des Ingenieurs Conseils, of which he was this year's president. Mr. Tritton was pleased to note that the World Bank now insisted on an independent consultant's report on any project to which it considered giving support. The toast of "the Guests" was proposed by Mr. J. T. Calvert, and the response was made by Mr. A. R. Low. Minister of State, Board of Trade. In referring to the activities of British consulting engineers in the Middle East, Mr. Low said that, apart from the Aswan dam scheme, new work totalling £12 million had been secured in the last twelve months in that region.

Lloyd's Register Annual Report

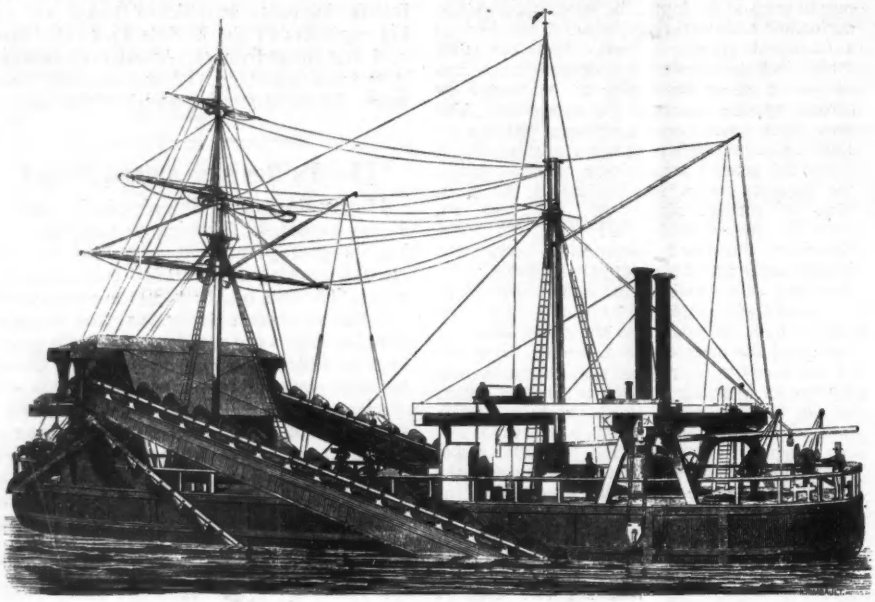
Lloyd's Register of Shipping has issued its annual report, 1955, which records that during the year plans were approved for 960 merchant ships of 4,510,210 tons gross, of which 565 ships of 3,019,230 tons were to be constructed abroad. It is noted that the most popular ship is the shelter decker with scantlings suitable for employment with a closed tonnage opening, and that more iron ore carriers were being built, including conversions from oil tankers. The growth of the size of tankers is recorded and special mention is made of the 52,000 tons deadweight ships being built in France and there is a note regarding the structural design of welded tankers, emphasizing the need to incorporate riveted seams or notch tough steel as crack arresters. The report mentions the approval of an outline specification for an extra high notch tough steel and refers to oxygen blown basic converter steel. In marine engineering a trend towards the installation of more machinery aft is noticed as is progress in the production of free piston engines in combination with exhaust gas turbines, while nuclear energy, as a source of power, is thought to be some ten to fifteen years away. A total of 567ships of 2,714,682 tons gross were completed during the year to Lloyd's classification ; work in hand amounted to 733 ships of 4,161,600 tons.

Engravings of 1861

Benson's high pressure steam generator, which is shown in the right-hand engraving, was first illustrated in our issue of April 5, 1861. This boiler was one of two which had been working for some time at Wednesbury. The description referred to "several series or sections of 1¼in. water-tubes, each section being continuously connected, so that the water forced in at the bottom shall be impelled through a lengthy circuit of tubing before reaching the top of the section." The pressure exerted by the steam, it was added, seldom exceeded 300 lb.

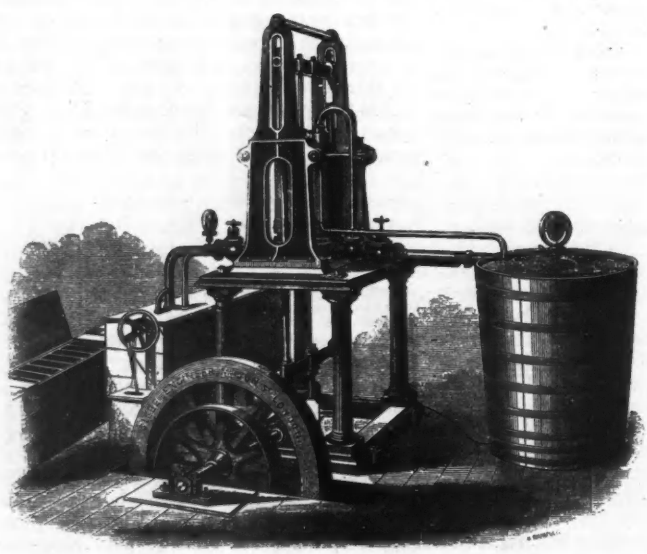


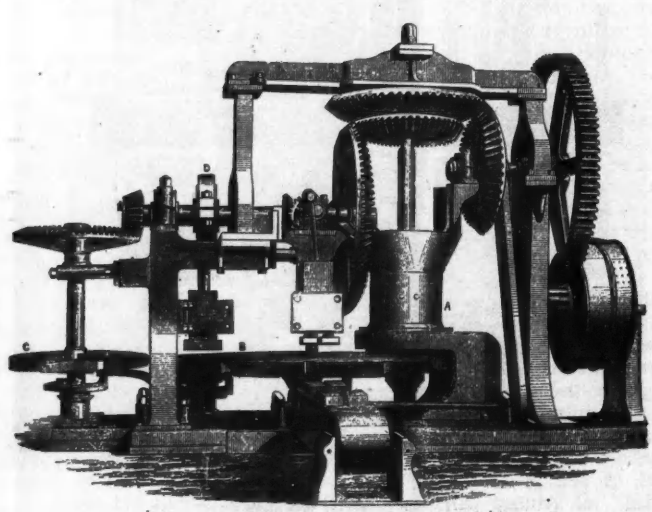
The steam dredger "Diligent" illustrated below was built for the Spanish Government by John and Alfred Blyth, London. It was 138ft. long, 31ft. 6in. broad, and 12ft. deep, the hull being built entirely of iron. In a description published on June 7, 1861, it was stated that the two "ladders", one on either side of the vessel, were each 95ft. long and carried forty buckets. It was claimed that the dredger would "excavate" advantageously at a depth of 50ft. below the surface of the water." The machinery was "a pair of oscillating condensing engines, of the collective power of 70 horses."



The left-hand engraving below shows an ice-making machine, invented by a Mr. Harrison and made by Mr. Siebe of Mason Street, Lambeth. it was described in our issue of April 12, 1861. We prefaced that description by commenting that "the artificial production of ice is now attracting increasing attention." The refrigeration, it was explained, was produced by the evaporation of ether in a vacuum, and the "peculiarity" of this invention consisted in the arrangements for evaporating the ether at a low temperature, and condensing it at a higher, which was "precisely the reverse of ordinary evaporating processes." The evaporating vessel, the description goes on, "is simply a tubular boiler, in in which the ether actually boils at a temperature (if required) 50deg. below the freezing point. The cold produced is utilised by means of a stream of salt water, which does not itself freeze at the temperature required for ice-making, but carries the cold to the vessels containing the fresh water intended for conversion into ice."

The brick making machine, shown in the right-hand engraving below, was made by Bradley and Craven, Wakefield. This machine, described on August 23, 1861, consisted of a pug mill into which clay was fed, and a moulding table, rotating under the mill, which contained twenty-four moulds in pairs. Motion was given to the table by "the lappet wheel C, which turned the table the length of two moulds." Between the action of the lappets, the table was stationary for a moment, during which time the pug mill filled two moulds brought beneath it. The full moulds, on the opposite side of the table to the mill, received pressure from the eccentric D, "making them best pressed bricks."





American Engineering News

BY OUR AMERICAN EDITOR

23ft Convertible Planing Machine

An interesting 23ft convertible Niles planing machine with a movable housing designed and built by the Baldwin-Lima-Hamilton Corporation, Hamilton, Ohio, has been installed at the Tiffin, Ohio, works of the National Machinery Company. The planer is being used principally to machine all the planed surfaces on large forging machine beds and allows any casting within the width and height limits permissible for flat wagon transport on American railways to be handled in one setting. The machine, which is shown in the accompanying illustration, is said to combine the rigidity and accuracy of a double housing planer with the versatility of a convertible planer. It admits work up to 15ft under the cross rail with a maximum width of 23ft and a minimum width of 13ft and has a planing length of 24ft.

23ft convertible Niles planing machine at Tiffin, Ohio, machining bed casting for a 2000-ton forging press

The machine has an adjustable auxiliary left-hand housing, and is equipped with two planing heads on the cross rail and two side heads, one of the side heads being mounted on the auxiliary housing. The planing speeds available range from 3·4 to 102 surface feet per minute. The machine has an overall rail width of 41ft and an overall height of 28ft 7½in above floor level, the auxiliary housing being situated 18ft below the floor line. All the head slides on the machine are made of cast steel, this construction making possible a 60in travel, instead of the usual 48in which would be possible with cast iron. All gibs for the heads are made of bronze instead of cast iron, to eliminate the problem of pick-up. The table itself has plastic wear plates on the ways. The tool heads have rapid traverse in all directions and power and hand feed for cross, vertical and angular travel. The tool slides and clapper boxes have independent swivels and swivel adjustments are made through a worm gear, pinion and a rack segment at the top of each member. The side heads also have power and hand feed for vertical, cross and angular travel, and rapid traverse in all directions. Instead of having a normal full width 22ft table, the planer is equipped with a 12ft wide table. This permits the operator to make a single set-up on work which is not of full width. If the narrow workpiece were set up on the right side of a very wide table it could be reached by the tools from the two rail heads and from the right side of the planer, but the left-hand tool would not be able to reach across the table. Thus, with a wide table it would have been necessary to make a second set-up to do the machining on the left side of the workpiece. In the present machine the narrow table permits the machining of three sides of the workpiece at one time, without a second set-up. To accommodate extra wide workpieces the National Machinery Company has an auxiliary track running parallel to the table so that a bogie riding on the track can be used to support the overhanging section of the workpiece.

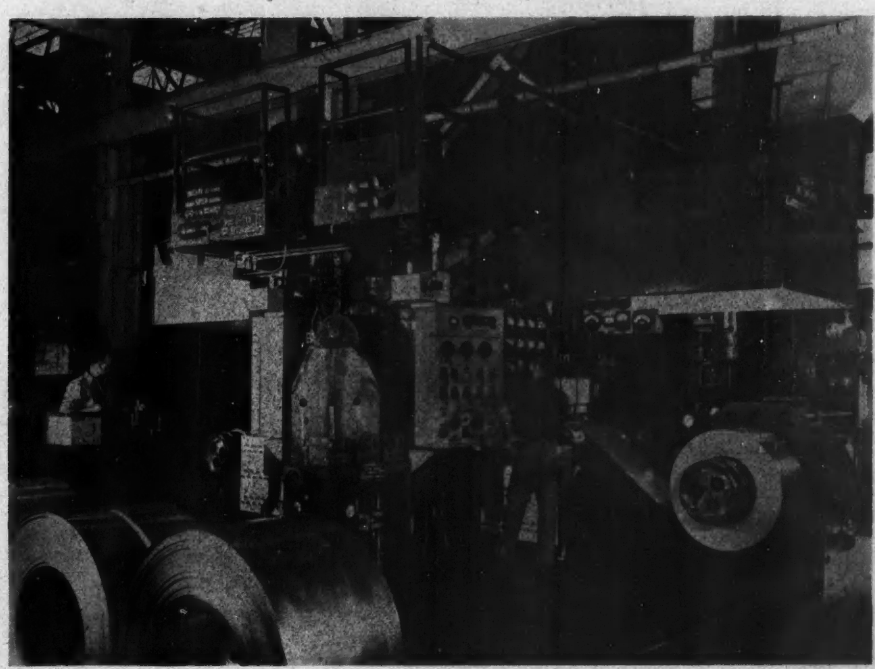
The adjustability of the left-hand auxiliary housing and planing head is considered to be one of the most important design aspects of the machine. It is this auxiliary housing that gives the machine its great flexibility. Situated between the left-hand stationary housing and the table the auxiliary housing is supported at the top and bottom by saddles dovetailed to the cross rail and to the lower auxiliary rail. The table has three tracks on the bed ; a " V "-way in the centre and flat ways on either side of the " V "-way. Horizontal power adjustment is provided by two traverse screws, one being situated on the cross rail and one in the lower auxiliary rail. The machine is driven by a 100 h.p. variable-voltage, 40 r.p.m. to 1200 r.p.m. variable-speed reversing motor.

The 100kW generator of the motor generator set is driven by a 150 h.p., 220/440V, three-phase, 60 c/s, 1800 r.p.m. motor. Other motors on the machine include a 40 h.p. motor for rail elevating, a 7½ h.p. motor for feed and traverse purposes on each of the four heads, and various motors for the rail clamp, the auxiliary housing traverse, the table drive and the table track lubricating pumps, the feed box and the lubricating pumps. The main drive motor is mounted below floor level on the right side of the machine facing the cross rail, and a deep pit for the auxiliary housing on the left side of the machine made it impossible to place the motor in the normal position.

Two High-Speed Strip Rolling Mills

Two new high-speed rolling mills have recently been installed at the Torrington, Connecticut, works of the American Brass Company to handle the growing demand for fine quality strip aluminium and copper-base alloys. The rolling mills are 10in and 29in by 36in, four-high reversing cold mills designed and built by the Lewis Machinery Division of the Blaw-Knox Company, Pittsburgh, Pennsylvania. Rolling strip at speeds ranging from 400ft to 1200ft per minute, the mills can cold reduce aluminium alloys with a maximum starting thickness of 0·125in down to a finished thickness of 0·010in, with intermediate anneals if necessary. The finished diameter of the coils is 20in I.D. and 49in maximum O.D., and they are 14in to 32½in wide. Each coil of strip metal weighs about 4800 lb.

Each mill is driven by a 600 h.p. main drive motor. One mill has one 75 h.p. motor and one 150 h.p. motor mounted in tandem with an interposing clutch driving each reel. The dual motors on the winders give the operator greater sensitivity in controlling the tension on the strip going through the mill. The other mill has a single 250 h.p. motor on each reel. Controls for the mill and for the auxiliary equipment are situated on the operator's cabinet which swivels to obtain good visibility and accessibility. Directly beside the operator are petcock controls for the spray nozzles and valve controls for the auxiliary equipment, the reels, the pinch rolls and the side guards. This auxiliary equipment and the controls for the mills themselves give the mills their versatility and ease of operation. Selsyns on the screw-down mechanism indicate the roll opening. Special wrap counters on the reels show instantly how many turns have been taken as the strip is coiled. An X-ray gauge



10in and 29in by 36in " Lewis " four-high reversing cold strip rolling mill at Torrington, Connecticut

mounted on the mill measures the thickness of the strip being rolled. In spite of their complexity and the various interlocking controls, the two mills are extremely compact. Where possible solenoid valves are used instead of hand valves to conserve space. The solenoids control such operations as expanding the mandrel, raising and lowering the pinch roll and adjusting the side guard. Both mills are serviced by a dual coolant system which can feed two different kinds of mineral coolant to the strip. It is possible with this system to put either coolant on either mill, or to put both mills on the same coolant. The coolant system controls the quantity and point of application of the spray to permit close control of the roll contour. Through a series of valves, the system is interlocked so the coolants cannot possibly be mixed.

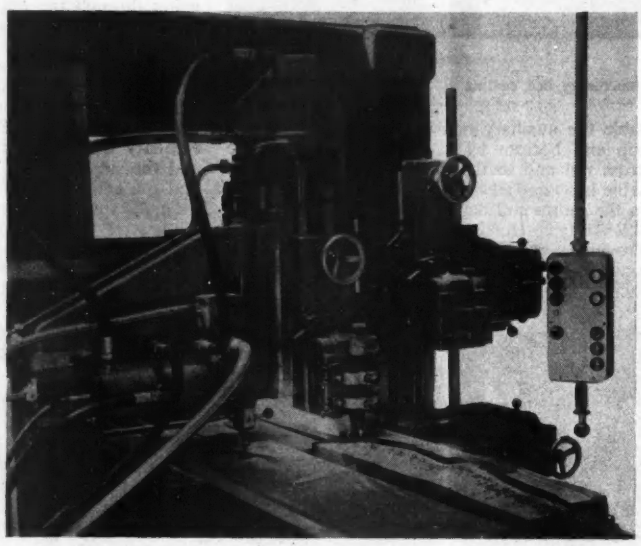
In addition to the two mills themselves, the American Brass Company has installed two new strip slitting lines and six furnace stations with two bell annealing units. The strip metal produced on the mills goes to the " drawing trade " and to the " cut-up trade " for use in such products as fan blades, condenser cans for the electronics industry and for electric bulb base material.

Continental Engineering News

Hydraulic Copying Attachment for Planing Machines

Our accompanying illustration shows a copying attachment for planing machines made by Werkzeugmaschinenfabrik Adolf Waldrich Coburg, Coburg/Bavaria. The copying support is shown mounted on the cross rail by the side of a second, ordinary, planing support. It consists of a slide with a hydraulic cylinder at the upper end, the piston-rod of which actuates the toolpost slide itself. On the tool slide is an arm which carries the tracer unit. This is laterally adjustable and comprises the tracer point which, by means of a rotary valve controls the admission of pressure oil to the top and bottom spaces of the tool cylinder. The movement of the rotary valve is effected hydraulically, a separate oil circuit complete with pump, adjustable relief valve and pressure gauge, being supplied for the purpose. A pressure of only 120 grammes is exerted by the tracer point, so that simple wooden patterns can be used without any danger of being damaged.

When the table reaches the end of its stroke the tool support is raised so that workpiece and model can be returned at increased speed. At the end of the return stroke a time delay causes the table to stop until the tracer has descended again. The tool is, of course, moved sideways by the amount of the next cut.



Double column planing machine equipped with hydraulic copying device

In a direction across the table angles up to 60 deg. from the horizontal can be copied, while with the table speed reduced to about 12m per minute longitudinal angles of up to 30 deg. can be copied. For steeper angles and recesses which cannot be planed a small milling head with end mill can be mounted in the toolpost in place of the planing tool. An auxiliary slow feed is used for the table in this case. Longitudinal angles of up to 60 deg. can then be copy-milled. Agent : Drummond-Asquith (Sales), Ltd., King Edward House, New Street, Birmingham, 2.

Improved Guide Roller for Conveyors

An improved design for a conveyor guide roller is given in the *Technical Digest* of the European Productivity Agency (E.P.A.). Paris. A cylindrical roller set at 90 deg. to the edge of the conveyor belt makes point contact with the belt and in consequence the edge of the belt is subjected to a great amount of wear. It is, however, possible to substitute a roller which makes line contact instead of point contact. The surface of such a roller is formed by rotating a hyperbola about the roller axis, with the axis of the hyperbola at right angles to the axis of the roller.

When such a roller is set up at the appropriate angle to the plane of the belt (about 30 deg. is the figure suggested), then the edge makes line contact with it. The design is reported to have been used successfully in the United States with belts ranging in width from 18in to 42in, and moving at speeds of up to 500ft per minute.

The *Technical Digest* is a monthly publication, available in this country from the D.S.I.R. Technical Information and Documents Unit, 15, Regent Street, London, S.W.1.

Television Traffic Control

An experiment in traffic control, employing television, is reported from Hamburg. In this test the policeman on point duty is replaced by a television camera, which can be advantageously positioned on a mast or building. The camera transmits a picture of the traffic to the control room at the police station, from where the traffic lights are operated. Of particular advantage will be a combination of several such cameras set to observe a number of interdependent road junctions. Such junctions, of course, are a notorious source of bottlenecks during peak hours. In Hamburg the police have worked out five programmes of changes of traffic lights for every important crossing, for use in various traffic situations. The controller at the control station will be able to observe the traffic on the television screens, and select by push-button those programmes most appropriate to the overall state of the traffic.

German Automobile Exports

In the calendar year 1955 a total of 908,841 motor vehicles of all kinds is reported to have been produced in the German Federal Republic, compared with an output of 680,597 units for 1954. This represents an increase of 33·5 per cent.

Sharply rising exports accounted for 106,000 of the total increase. The whole of the export figure for last year was 403,857 automobiles, some of them purchased with foreign currency inside the boundaries of the Federal Republic. The proportion of cars exported to cars produced was 43·8 per cent in 1954 and 44·4 per cent last year. These exports and those of parts have been valued at DM. 2500 million for last year and DM. 1800 million the year before. For 1954 the share of the automobile industry in the total West German export trade was 8·2 per cent.

Launches and Trial Trips

NATAL, cargo ship ; built by the Chantiers Navals de la Ciotat for the Messageries Maritimes ; length overall 488ft 4½in, length between perpendiculars 467ft 8in, breadth moulded 61ft 8in, depth to shelter deck 38ft 11in, draught loaded 25ft 7in, deadweight 8300 tons, load displacement 14,079 tons, speed 16 knots ; six passengers ; three complete decks, seven watertight bulkheads, five holds, one 60-ton, one 30-ton, four 10-ton, ten 5-ton derricks, geared electrical winches ; three 250kW diesel-driven generators, one 30kW emergency generator ; one single-acting, two-stroke Burmeister and Wain engine of 8300 h.p. at 115 r.p.m. Trial, January.

SAN FELIPE, oil tanker ; built by Smith's Dock Company, Ltd., for the Eagle Oil Tanker Company, Ltd. ; length between perpendiculars 530ft, breadth moulded 69ft 3in, depth moulded 39ft, deadweight 18,000 tons on 29ft 6in draught, service speed 14½ knots ; thirty-three cargo oil tanks, one main cargo pump room, four 400 tons-per-hour turbo-driven cargo pumps, two stripping pumps, steam deck machinery ; two 550kW turbo-alternators, one 200kW diesel-driven alternator ; one set of Hawthorn Leslie two-casing, double-reduction geared turbines, supplied with steam at 500 lb per square inch and 800 deg. Fah. by two Foster Wheeler boilers. Launch, January 27th.

Miscellanea

FILLER FOR POLYESTER RESIN.—A special grade of precipitated calcium carbonate, known as " Calofil," is supplied by John and E. Sturge, Ltd., Wheeleys Road, Birmingham, for use as a filler for polyesters. It is claimed to increase the rigidity of the product and thereby allow lighter sections to be used, and also to impart a good surface finish. " Calofil " is a low-oil-aosorption calcium carbonate coated with 1 per cent resin and mixed in equal proportions with the resin. It was used in the construction of the glass-reinforced resin moulded Willerby " Vista " caravan, which has two shells separated by an air gap, each shell made in sections, with the colour extending right through the material.

ROYAL SOCIETY OF HEALTH'S ANNUAL CONGRESS.—The annual congress of the Royal Society of Health, which this year is to be held at Blackpool from April 24th to 27th, will include sections in which relevant engineering problems and related subjects, such as housing and town planning, will be discussed. On Thursday, April 26th, the morning session will comprise the reading of the papers " Problems of River Pollution in Industrial Areas," by L. Klein, and " The Water Pollution Research Laboratory and its Work," by B. A. Southgate. On the following afternoon the two papers " Modular Co-ordination," by B. Martin, and " New Building Materials and Methods," by G. I. Goulden, will be presented in the " engineering and architecture " section.

FUME DUCTS IN PLASTIC MATERIAL.—A range of polythene and P.V.C. tubes and ducts is now being made by Rediweld, Ltd., Crawley, Sussex, for the construction of duct lines for corrosive fumes. These parts are marketed under the trade name " Polynert," and standard sections are available in 3ft lengths, with dimensions graduated in 2in " steps " from 4in to 30in. The various sections have all the appropriate flanges, elbows, T-pieces, backing rings and joints necessary for fume disposal systems. The thickness of the sheet stock used for pipes and fittings is $\frac{1}{16}$in, whilst flanges are based on $\frac{1}{4}$in stock. To simplify the work of designers considering the use of " Polynert," fittings a set of paper cut-outs representing the various standard sections at a scale of 1/12 are available. The designer has merely to lay the cut-outs on the plan view and elevations of the building concerned, and when a satisfactory layout has been decided upon the cut-outs can be secured to the drawings and sent to the makers for a quotation.

HUMAN FACTORS IN ROAD TRANSPORT.—A symposium entitled " Human Factors in Road Transport " has been arranged by the Ergonomics Research Society ; it will be held at the University of Bristol from April 16th to April 19th. About a score of papers are to be presented, nearly half of them from foreign authors. After the opening session, a paper entitled " An Analysis of Road Transport " will be followed by a series of papers on various aspects of road and vehicle lighting, including, for instance, dissertations on the effects of glare, and of visibility of road signs, and on the use of flashing indicators. The second session is on " drivers' behaviour " and includes four papers ; the third is on " Physiological Aspects." In these two sessions the papers range over such subjects as the objective measurement of drivers' performance, the effects of alcohol on drivers, the expenditure of human energy in transport and in driving, and the design of crash helmets. On the Thursday morning there will be two further papers, " Some Problems Concerning Elderly Locomotive Drivers," and " Transport Problems on Polar Expeditions."